## 12. Detailed Analysis of Alternatives

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# TABLES

# 12. DETAILED ANALYSIS OF ALTERNATIVES

The remedial alternatives retained in the initial screening (see Section 11) are further evaluated below in a detailed analysis that evaluates remedial alternatives against the CERCLA criteria. Results of this analysis will form the basis for future activities such as identification of preferred alternatives for the sites and preparation of the WAG 5 comprehensive proposed plan. Subsequent to appropriate reviews of the RI/FS and the proposed plan and comment resolution, the detailed analysis will support the final selection of remedial actions for WAG 5 sites and preparation of the ROD.

## 12.1 Introduction

The detailed analysis assesses remedial action alternatives for seven of the nine CERCLA evaluation criteria that can be addressed before public comment (40 CFR 300.430; EPA 1988). The nine criteria are divided into three categories: threshold, balancing, and modifying. The first two criteria (overall protection of human health and the environment, and compliance with ARARs) are classified as threshold criteria. A remedial action must satisfy these two criteria in the detailed analysis to be a candidate preferred alternative. The next five criteria, used to weigh major tradeoffs among alternatives, are classified as balancing criteria. The five balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. The last two criteria, classified as the modifying criteria, are state acceptance and community acceptance. The modifying criteria are used to address the acceptability of remedial alternatives to stakeholders. Remedial alternatives will be evaluated against the two modifying criteria after the WAG 5 comprehensive RI/FS and proposed plan have been reviewed by the public and comments have been resolved.

The intent of this analysis is to present sufficient relevant information to allow DOE-ID, EPA, and IDHW, with input from the public, to select appropriate remedies. Evaluation against all nine criteria, including public and state acceptance, is the basis for determining the ability of a remedial action alternative to satisfy CERCLA remedy selection requirements.

The detailed analysis is conducted in two distinct phases. In the first phase, the alternatives are assessed individually against the evaluation criteria. In the second phase, the results of the individual analyses are then used in a relative or comparative analysis. This second analysis identifies advantages and disadvantages of the alternatives relative to one another so that the key tradeoffs that decision makers must balance can be identified.

A description of each of the nine evaluation criteria outlined in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 CFR 300.430(e)(9)(iii)] and EPA guidance (EPA 1988) is presented below.

### 12.1.1 Overall Protection of Human Health and the Environment

The remedial action alternatives are assessed to determine whether they adequately protect human health and the environment, in both the short and long term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at a site by eliminating, reducing, or controlling exposures to levels established during the development of remediation goals consistent with the NCP. Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

### 12.1.2 Compliance with ARARs

The remedial action alternatives are assessed to determine whether they either meet ARARs under federal environmental laws and state environmental or facility siting laws or provide grounds for invoking one of the waivers provided in the NCP. In addition, TBCs are evaluated under this criterion. Based on an assessment of all available data for the WAG 5 sites, RCRA ARARs will apply only to the ARA-02 seepage pit sludge and structures (e.g., pumice blocks, septic tanks, and associated piping) and the ARA-16 tank and waste. If additional sampling during remediation indicates that RCRA ARARs apply to any of the contaminated soil sites, the ARARs listed in Table 12-1 will be reconsidered for each site as indicated by the sampling.

### 12.1.3 Long-Term Effectiveness and Permanence

The remedial action alternatives are assessed for long-term effectiveness and permanence, along with the degree of certainty that the alternative would prove successful. Factors that are considered, as appropriate, include the following:

- **Magnitude of residual risk remaining from untreated waste or treatment residuals at the conclusion of the remedial activities.** The extent that residual contamination remains hazardous, taking volume, toxicity, mobility, and propensity to bioaccumulate into account, should be considered.

- **Adequacy and reliability of measures such as containment systems and institutional controls that are necessary to manage treatment of residuals and untreated waste.** This factor addresses, in particular, the uncertainties associated with land disposal for providing long-term protection from residual contamination; the assessment of the potential need to replace technical components of the alternative, such as a cap, slurry wall, or treatment system; and the potential exposure pathways and risks posed should the remedial action need replacement.

### 12.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The degree to which the remedial action alternatives employ recycling or treatment that reduces toxicity, mobility, or volume is assessed, including how the treatment addresses the principal threats posed by a site. Factors that may be considered include (1) the treatment or recycling processes that the alternatives employ and the materials they will treat; (2) the amount of hazardous substances, pollutants, or contaminants that will be destroyed or recycled; (3) the degree of expected reduction in toxicity, mobility, or volume of the waste because of the treatment or recycling and the specification of which reductions are occurring; (4) the degree to which the treatment is irreversible; (5) the types and quantities of residual contamination that will remain following treatment, taking into consideration the persistence, toxicity, mobility, and propensity to bioaccumulate; and (6) the degree to which treatment reduces the inherent hazards posed by the principal threats at the site.

### 12.1.5 Short-Term Effectiveness

The short-term impacts of the implementation period for each of the alternatives are assessed considering (1) the short-term risks that might be posed to the community during implementation of an alternative, (2) the potential impacts to workers during remedial action and the effectiveness and reliability of protective measures during implementation, (3) the potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation, and (4) the time until protection is achieved.

**Table 12-1.** Applicable or relevant and appropriate requirements that will be reconsidered if additional sampling during remediation indicates that RCRA applies to any of the contaminated soil sites.

| Statute | Citation | Alternative 1 No Action | Alternative 3b Consolidation and Containment with Engineered Barrier | Alternative 4a Removal and Disposal on the INEEL | Alternative 4b Removal and Disposal off the INEEL | Alternative 5a Removal, Ex Situ Sorting, and Disposal on the INEEL | Alternative 5b Removal, Ex Situ Sorting, and Disposal off the INEEL |
|---|---|---|---|---|---|---|---|
| Definition of a Solid Waste | IDAPA 16.01.05.005 (40 CFR § 261.2) | No | Yes | Yes | Yes | Yes | Yes |
| Toxicity Characteristic | IDAPA 16.01.05.005 (40 CFR § 261.24) | No | Yes | Yes | Yes | Yes | Yes |
| Hazardous Waste Determination | IDAPA 16.01.05.006 (40 CFR § 262.11) | No | Yes | Yes | Yes | Yes | Yes |
| Manifest Requirements for Off-Site Transportation | IDAPA 16.01.05.006 (40 CFR 262, Subpart B) | No | No | No | Yes | No | Yes |
| Equipment Decontamination | IDAPA 16.01.05.008 (40 CFR § 264.114) | No | Yes | Yes | Yes | Yes | Yes |
| Use and Management of Containers | IDAPA 16.01.05.008 (40 CFR 264, Subpart I) | No | No | No | Yes | No | Yes |
| Landfill Closure and Post Closure | IDAPA 16.01.05.008 (40 CFR § 264.310(a) 1–5 and (b) 1,4,5,6) | No | Yes | No | No | No | No |
| Miscellaneous Units | IDAPA 16.01.05.008 (40 CFR 264, Subpart X) | No | No | No | No | Yes | Yes |
| Land Disposal Restrictions, including Phase IV | IDAPA 16.01.05.011 (40 CFR 268) | No | Yes | Yes | Yes | Yes | Yes |

a. In addition to the ARARs analyzed above, CERCLA off-site disposal policy is a regulation to be considered for Alternatives 4b and 5b.

### 12.1.6 Implementability

The ease or difficulty of implementing the remedial action alternatives is assessed by considering the following types of factors, as appropriate: (1) technical feasibility including the technical difficulties and unknowns associated with the construction and operation of the technology, the reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy; (2) administrative feasibility including the activities required to coordinate with other offices and agencies and the ability and time needed to obtain any necessary approvals and permits; and (3) availability of services and materials including the availability of adequate treatment, storage capacity, disposal capacity and services, necessary equipment and specialists, availability of prospective technologies, and any necessary additional resources.

### 12.1.7 Cost

Cost estimates are developed for the remedial action alternatives for comparison purposes only and are not intended for budgetary, planning, or funding purposes. Estimates have an estimated range of accuracy of +50 to -30%, in accordance with EPA guidance for conducting feasibility studies under CERCLA (EPA 1988). The general methodology, assumptions, and derivations of alternative cost estimates are provided in Appendix K. The types of costs assessed include (1) management and oversight costs, which would be incurred primarily by the INEEL Environmental Restoration Program; (2) cleanup costs, including construction management and oversight, remedial design/remedial action (RD/RA) document preparation, and reporting costs; (3) remedial design costs; (4) construction costs including general and administrative and construction subcontract fees; (5) operations costs; and (6) surveillance and monitoring costs. All initial and future life-cycle costs are normalized to represent present worth. Present worth is the cumulative worth of all costs, as of the beginning of the first year of activities, accounting for inflation of future costs. Present worth costs are estimated assuming variable annual inflation factors for the first 10 years, in accordance with U.S. Department of Energy Order 430.1, followed by a constant 5% annual inflation rate. A constant 5% discount rate is assumed. Note that "present worth" is referred to as the "net present value" in the Summary Cost Estimate Sheets provided in Appendix K.

Total project cost in fiscal year 1998 dollars and costs in escalated dollars are presented in Appendix K. The assumptions used to develop cost estimates also are presented. Total project cost in fiscal year 1998 dollars is the cost of performing all of the work in 1998, without any inflation of costs for future work, while the escalated dollar estimate is the cost of performing all of the work, accounting for inflation but without discounting to present worth.

Note that in all cases the "construction subcontract" costs, (i.e., the actual costs of construction) are much less than the present worth. Management and oversight, both by the INEEL Maintenance and Operations contractor and the construction subcontractor, account for a significant fraction of the total present worth in some cases. One hundred years of maintenance, surveillance, and monitoring also become a significant part of the present worth for those alternatives incorporating long-term maintenance and monitoring.

### 12.1.8 State Acceptance

Remedial action alternatives are not evaluated in accordance with state acceptance during the detailed analysis. However, IDHW concerns about the WAG 5 comprehensive RI/FS will be resolved before the WAG 5 comprehensive proposed plan is issued for public comment. Representatives from IDHW are active in the development and evaluation of remedial alternatives in the RI/FS, and the

proposed plan and ROD for WAG 5 will be developed through consensus by DOE-ID, EPA, and IDHW participants.

### 12.1.9 Community Acceptance

The assessment of community acceptance includes determining which components of the remedial action alternatives interested persons in the community support, have reservations about, or oppose. The assessment will be completed through comments on the WAG 5 comprehensive proposed plan.

Alternatives are not evaluated in accordance with community acceptance during the detailed analysis. In accordance with EPA guidance for conducting feasibility studies under CERCLA (EPA 1988), community acceptance will be evaluated following comment on the RI/FS report and the proposed plan. The criterion will be addressed during selection of a remedy and while the ROD is being prepared (EPA 1988).

## 12.2 Individual Analysis of Alternatives

In accordance with EPA guidance (EPA 1988), remedial action alternatives retained for detailed analysis were individually assessed in the FS against the evaluation criteria listed above, not including state and community acceptance. The individual analysis of each alternative against the two threshold criteria and five balancing criteria is presented in the following subsections.

### 12.2.1 Contaminated Soils

***12.2.1.1 Alternative 1: No Action.*** The no action alternative provides a baseline against which other alternatives can be compared. This alternative consists of soil, air, and groundwater monitoring to assess conditions at WAG 5 sites. For this FS and to meet the intent of the NCP, it is assumed that under the no action alternative, the sites could become immediately accessible to the general public.

***12.2.1.1.1 Overall Protection of Human Health and the Environment***—Under the no action alternative, human health and ecological risks at WAG 5 contaminated soil sites would be the same as those identified in the BRA (see Section 6) for the current occupational scenario and greater than the risks estimated for the 100-year future residential scenario. The BRA identifies risks in excess of 1E-04 in the 100-year future residential scenario from external exposure to contaminated soils. The absence of controls for contaminated soils results in no reduction in risks other than by natural radioactive decay. Remedial action objectives would not be satisfied because risks to human and ecological receptors would not be reduced.

***12.2.1.1.2 Compliance with ARARs and TBCs***—The evaluation of the no action alternative for compliance with ARARs and with TBCs is presented in Table 12-2. The no action alternative does not implement any construction or operational activities that would result in disturbances to the surfaces of WAG 5 sites. However, the Idaho Administrative Procedures Act (IDAPA) 16.01.01.650 and .651 could nonetheless apply to any site that is a source of fugitive dust; therefore, the IDAPA provision is considered an ARAR even though no action would be taken at the soil sites that would generate dust. The no action alternative would not satisfy the IDAPA ARAR. The National Emission Standards for Hazardous Air Pollutants (NESHAP) (40 CFR 61.90) would not be met after the period of institutional control.

The no action alternative would not meet the DOE Order 5400.5, "Radioaction Protection of the Public and the Environment," TBC because excessive estimated health risks to current workers and potential future residents would not be mitigated.

**Table 12-2.** Evaluation of compliance with ARARs and TBCs for contaminated soil sites, Alternative 1: No Action.

| ARAR or TBC | Type | Citation | Met Evaluation[a] |
|---|---|---|---|
| Rules for Control of Air Pollution in Idaho | Action | IDAPA 16.01.01.650–.651, Fugitive Dust | No |
| National Emission Standards for Hazardous Air Pollutants | Action | 40 CFR 61.91 and .92, National Emission Standards for Emissions of Radionuclides Other than Radon from DOE Facilities | No |
| Limit of 100 mrem/year effective dose equivalent to the public from exposures to external and internal radiation sources. | TBC | DOE Order 5400.5, "Radiation Protection of the Public and the Environment" | No |
| Limit of 10 mrem/year effective dose equivalent to the public from airborne releases. | TBC | DOE Order 5400.5 | No |

a. A yes in the Met Evaluation column indicates that the alternative meets the ARAR or TBC.

***12.2.1.1.3 Reduction of Toxicity, Mobility, or Volume Through Treatment***—No treatment is associated with this alternative.

***12.2.1.1.4 Short-Term Effectiveness***—The evaluation of the no action alternative incorporates the assumption that sites would be immediately available to the general public. An institutional control period is not considered. Because the no action alternative does not include mitigative measures to address risks to residential receptors, and immediate access is postulated, short-term risks are greater than those estimated in the BRA for the 100-year future residential scenario. Therefore, the short-term effectiveness for the no action alternative is low.

***12.2.1.1.5 Implementability***—No specialized equipment, personnel, or services are required to implement the no action alternative. This alternative can be implemented immediately without additional risks to the community, workers, or the environment.

***12.2.1.1.6 Cost***—The estimated costs, $14 million, for the no action alternative for WAG 5 contaminated soil sites are summarized in Table 11-1 and presented in detail in Appendix K. Post-closure cost estimates include the full duration of the 100-year period of monitoring.

***12.2.1.2 Alternative 3b: Excavation, Consolidation, and Containment with an Engineered Barrier.*** The primary remedial action involved with Alternative 3b is excavation and consolidation of the contaminated soil sites and construction of an engineered barrier like the one constructed over the SL-1 Burial Ground (Parsons 1997). Environmental monitoring, access restrictions, and surface water diversions also are included with this alternative. The engineered cover is designed to isolate radioactive waste and chemically contaminated soils from potential migration pathways of concern and to reduce surface exposures to background levels. In addition, the barrier minimizes water erosion that could result in exposure and migration of contaminants. The barrier is approximately 4.5 ft (1.6 m) thick with functional redundancy in the layers; therefore, minimal maintenance is required.

***12.2.1.2.1 Overall Protection of Human Health and the Environment***—The design basis for the SL-1 type barrier is a rock armor cover with functional and operating requirements to

(1) isolate radiologically contaminated soils and debris from human and biotic intrusion and (2) provide direct radiation shielding for at least 400 years. Section 9 includes a general discussion of the conceptual design. The SL-1 type cover, combined with institutional controls and monitoring, is expected to be highly effective in protecting human health and the environment, thus satisfying all RAOs for WAG 5 contaminated soil sites of concern.

***12.2.1.2.2 Compliance with ARARs and TBCs***—The evaluation of containment Alternative 3b for compliance with ARARs and TBCs is presented in Table 12-3. Performing excavation using air monitoring and dust suppression, as needed, would ensure compliance with all ARARs for emissions controls. Toxic contaminants may be an issue during excavation; modeling will be conducted before remedial action to determine whether toxic limits will be exceeded. No emissions would be anticipated after a protective cover is in place. Additional potential ARARs associated with the siting, construction, and operation of the soil consolidation site within WAG 5 are not evaluated in Table 12-3.

Available data indicate that no RCRA hazardous waste is present at WAG 5 soil sites of concern. This conclusion will be verified through analysis and waste designation during excavation. If any soils are determined to be classified as RCRA-regulated waste, the ARARs listed in Table 12-1 for this alternative will apply. These soils will be disposed of at a compliant facility, such as the proposed ICDF or Envirocare. Therefore, the RCRA ARARs will be met.

**Table 12-3.** Evaluation of compliance with ARARs and TBCs for contaminated soil sites, Alternative 3b: Excavation, Consolidation, and Containment with an Engineered Barrier.

| ARAR or TBC | Type | Citation | Met Evaluation[a] |
|---|---|---|---|
| Idaho Hazardous Waste Management Act | Action | IDAPA 16.01.05.006, which incorporates RCRA by reference | Yes |
| Resource Conservation and Recovery Act | Action | 40 CFR 262.11, Hazardous Waste Determination | Yes |
| Rules for Control of Air Pollution in Idaho | Action | IDAPA 16.01.01.650-.651, Fugitive Dust | Yes |
| Rules for Control of Air Pollution in Idaho | Action | IDAPA 16.01.01.210, 585, and .586, Toxic Air Pollutants | Yes |
| National Emission Standards for Hazardous Air Pollutants | Action | 40 CFR 61.91 and .92, national emission standards for emissions of radionuclides other than radon from DOE of energy facilities | Yes |
| Native American Graves Protection and Repatriation Act | Location | 25 USC 32 | Yes |
| National Historic Preservation Act | Location | 36 CFR 800 | Yes |
| Limit of 100 mrem/year effective dose equivalent to the public from exposures to external and internal radiation sources. | TBC | DOE Order 5400.5, "Radiation Protection of the Public and the Environment" | Yes |
| Limit of 10 mrem/year effective dose equivalent to the public from airborne releases. | TBC | DOE Order 5400.5 | Yes |

a. A yes in the Met Evaluation column indicates that the alternative meets the ARAR or TBC.

All areas affected by WAG 5 remedial activities will be surveyed for archeological and cultural resources before disturbance. Activities in sensitive areas would be modified as required to satisfy the potential ARARs (i.e., 25 USC 32 and 36 CFR 800). The requirements of the DOE Order 5400.5 TBC would be met during construction by use of controls and by the design and maintenance of the barrier. Alternative 3b is, therefore, considered capable of complying with all identified ARARs and TBCs.

***12.2.1.2.3 Long-Term Effectiveness and Permanence***—Containment using an engineered barrier with institutional controls is highly effective for preventing external exposure to contaminated soil. The engineered cover is designed to maintain its effectiveness for at least 400 years with minimal maintenance. The functional requirements of the design are to provide sufficient shielding to reduce direct radiation exposure risks, resist erosion, resist biotic and human intrusion, and inhibit biotic transport of contaminants to the surface. Though the SL-1 type cover is designed to be maintenance free (Parsons 1997), cap integrity monitoring and periodic removal of undesirable vegetation and burrowing animals are maintenance requirements that would be performed as needed during the institutional control period.

This cap would not attenuate or divert infiltration, and likely would increase infiltration through contaminated soils. However, reducing infiltration is not an RAO.

Erosion and human intrusion are the most likely causes of barrier failure resulting in external exposure to contaminated soil. The physical size of the SL-1 type cover and the texture of the component layers specified in the design are considered effective for erosion resistance. Inadvertent human intrusion through the basalt riprap layer would be unlikely, but no barrier is completely effective in preventing intentional human intrusion.

***12.2.1.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment***—No treatment is associated with the containment alternative.

***12.2.1.2.5 Short-Term Effectiveness***—Short-term risks to workers and the environment during excavation, consolidation of soils, and installation of the engineered cover are moderate. Health risks to workers during excavation, consolidation, and installation of the engineered barrier could be effectively mitigated using standard administrative and engineering controls including dust suppression and appropriate personal protective equipment. Excavation equipment modified with positive-pressure ventilation cabs and high-efficiency particulate air (HEPA) filters for use in radiologically contaminated areas is available at the INEEL from previous remedial actions undertaken elsewhere. Inhalation and ingestion risks caused by toxic metals in soil could be minimized by use of appropriate personnel protective equipment, engineering controls, and adherence to health and safety protocols.

In addition to risks caused by exposure to contaminants, risks associated with the construction of the barrier include physical construction hazards, such as vehicle accidents or personal injury. Construction hazards can be minimized by implementation of appropriate health and safety measures for earth-moving construction activities. All construction materials for the cap designs are available at the INEEL or within the surrounding communities. Shipment from distant off-Site locations is not anticipated. Therefore, minimal risks are associated with transportation of construction materials.

Environmental impacts resulting from excavation and construction activities would be minimal at previously disturbed areas, but could be major at largely undisturbed areas such as ARA-23. The landscape would be disturbed because of the equipment and vehicles moving in and around the excavation sites. Installation of surface water diversion controls may result in alteration of the nearby terrain. However, the overall impact of these activities is not irreparable and would be unnoticeable in the

long term. The remoteness of the site would prevent any impact to the surrounding communities during construction activities.

Sensitive resources such as archaeological sites exist in the vicinity of the WAG 5 soil sites. Therefore, WAG 5 sites will be surveyed before any remedial actions. If cultural or archeological resources are discovered, the effects of the remedial action on the resources and options to mitigate adverse impacts will be determined and evaluated. Actions will be taken to comply with ARARs that protect cultural and archeological resources.

Remedial action objectives would be achieved by a containment alternative once construction of the barrier is complete. Approximately 12 to 20 months is assumed for design, procurement, and equipment and personnel mobilization. Based on construction schedules for the INEEL SL-1 and BORAX-I Burial Grounds caps (Parsons 1997), it is probable that an SL-1 type barrier can be constructed within a 3-month period. An additional 18 to 24 months would be required to prepare environmental assessments, safety analysis, and the RD/RA documentation.

***12.2.1.2.6 Implementability***—This alternative is readily implementable. The engineered cover is constructed of natural materials and uses conventional construction equipment and methods. The SL-1 barrier design has previously been selected, designed, and implemented on the INEEL. Therefore, the technology, services, and specialists required to implement this alternative are available within DOE. Construction materials and equipment are available at the INEEL or from nearby communities. Technical implementability is considered high because of the previous application of this design at the INEEL. However, community acceptance and state acceptance are not considered at this stage of the evaluation of alternatives. Therefore, the implementability of the soil consolidation alternative relative to stakeholder acceptance is not evaluated.

***12.2.1.2.7 Cost***—The cost estimate developed for this alternative is based on the use and operation of excavation equipment, construction of the SL-1 type cover, installing surface water diversion controls, using monitoring equipment, conducting analyses, and post-closure maintenance and monitoring. Post-closure costs were estimated for the full duration of the 100-year period of maintenance and monitoring. The estimated costs for implementing this alternative, $24 million, are summarized in Table 11-1 and presented in detail in Appendix K.

***12.2.1.3 Alternatives 4a and 4b: Removal and Disposal.*** Alternatives 4a and 4b differ only in the final disposal location of the contaminated soils. The proposed on-Site ICDF would be used for Alternative 4a while a private disposal facility located off the INEEL would be used for Alternative 4b. The representative facility off the INEEL considered for evaluation in this FS for cost-estimating purposes is Envirocare in Clive, Utah. The seven CERCLA screening criteria (EPA 1988) are considered to be the same for both alternatives with the exception of the additional transportation costs and potentially larger disposal costs.

***12.2.1.3.1 Overall Protection of Human Health and the Environment***—Alternatives 4a and 4b provide highly effective, long-term protection of human health and the environment. The removal of all contaminated soil from WAG 5 sites of concern would eliminate potential long-term human health and environmental concerns associated with future exposure to, or contaminant migration from, uncontrolled release sites. Both the INEEL site and the off-Site disposal facility would provide isolation of the contaminated soils (1) within a controlled area in which waste management controls are in place and (2) for at least the period of institutional control.

Alternatives 4a and 4b also are protective of the environment during implementation because mitigative measures to prevent contaminant migration during excavation activities would be

implemented. However, short-term protection of human health is less effective because workers would receive direct exposure to contaminated soil during excavation. However, all potential risks during implementation could be controlled through administrative and engineering controls. Waste generated during remedial actions would consist of only relatively small quantities of equipment decontamination fluids and discarded personal protective equipment.

***12.2.1.3.2 Compliance with ARARs***—The evaluation of Alternatives 4a and 4b for compliance with ARARs and TBCs is presented in Table 12-4. Available data indicate that no RCRA hazardous waste is present at WAG 5 contaminated soil sites. This conclusion will be verified through analysis and waste designation during excavation. If any soils are determined to be classified as RCRA-regulated waste, the ARARs listed in Table 12-1 for this alternative will apply. These soils will be disposed of at a compliant facility, such as the proposed ICDF or Envirocare. Therefore, the RCRA ARARs will be met. Compliance with the emission control ARARs would be ensured by implementing air monitoring and dust suppression techniques during excavation. Department of Energy Order 5400.5, "Radiation Protection of the Public and the Environment," would be met by implementing and enforcing applicable provisions of the order. The two alternatives are, therefore, capable of complying with ARARs and TBCs.

***12.2.1.3.3 Long-Term Effectiveness***—Alternatives 4a and 4b would achieve long-term protection because soil contamination at levels above PRGs would be completely removed from WAG 5 and transferred to a managed waste disposal facility, either the proposed ICDF or an off-Site facility such as Envirocare. Therefore, long-term effectiveness and permanence for Alternatives 4a and 4b is classified as high.

***12.2.1.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment***—No treatment is associated with this alternative.

**12.2.1.3.5 *Short-Term Effectiveness***—The exposure risks to workers during excavation and removal of contaminated soil at WAG 5 sites could be significant; however, radiation monitoring and dust control measures have been demonstrated to effectively mitigate risks in previous INEEL removal actions. Short-term effectiveness is, therefore, considered moderate. Equipment operator exposures to soils contaminated with radionuclides or toxic metals would be inhibited using standard protective measures. Supplied air and shielding would be used as needed. Excavation equipment modified with positive-pressure ventilation system cabs and HEPA filters for use in radiologically contaminated areas is available at the INEEL. Excavation equipment can be modified to provide additional protection in radiologically contaminated environments if necessary. Equipment operator risks will be directly related to the time required to perform the excavation along with distance from the soil and shielding provided by equipment and protective clothing. Inhalation and ingestion risks caused by toxic metals in soil could be minimized by use of appropriate personnel protective equipment, engineering controls, and adherence to health and safety protocols.

In addition to risks caused by exposure to contaminants, risks associated with the physical construction hazards such as vehicle accidents or personal injury can be minimized by implementation of appropriate health and safety measures for earth-moving construction activities.

Environmental impacts resulting from Alternatives 4a and 4b would depend on the remedial design and required access areas. The surrounding landscape likely would be disturbed because of the equipment and vehicles moving in and around the excavation sites. However, the impacts of these activities would be temporary and the sites would be restored to match the surrounding landscape at the

**Table 12-4.** Evaluation of compliance with ARARs and TBCs for contaminated soil sites: Alternative 4a, removal and disposal on the INEEL, and Alternative 4b, removal and disposal off the INEEL.

| ARAR or TBC | Type | Citation | Met Evaluation[a] |
|---|---|---|---|
| Idaho Hazardous Waste Management Act | Action | IDAPA 16.01.05.006, which incorporates RCRA by reference | Yes |
| Resource Conservation and Recovery Act | Action | 40 CFR 262.11, Hazardous Waste Determination | Yes |
| Rules for Control of Air Pollution in Idaho | Action | IDAPA 16.01.01.650-.651, Fugitive Dust | Yes |
| Rules for Control of Air Pollution in Idaho | Action | IDAPA 16.01.01.210, 585, and .586, Toxic Air Pollutants | Yes |
| National Emission Standards for Hazardous Air Pollutants | Action | 40 CFR 61.91 and .92 national emission standards for emissions of radionuclides other than radon from DOE facilities | Yes |
| Native American Graves Protection and Repatriation Act | Location | 25 USC 32 | Yes |
| National Archeological and Historic Preservation Act | Location | 36 CFR 800 | Yes |
| Limit of 100 mrem/year effective dose equivalent to the public from exposures to external and internal radiation sources. | TBC | DOE Order 5400.5, "Radiation Protection of the Public and the Environment" | Yes |
| Limit of 10 mrem/year effective dose equivalent to the public from airborne releases. | TBC | DOE Order 5400.5 | Yes |

a. A yes in the Met Evaluation column indicates that the alternative meets the ARAR or TBC.

completion of the project. Sensitive archeological resources exist at WAG 5 contaminated soil sites of concern. Surveys would be conducted at all sites before any disturbance. In the event that archeological resources are discovered, an assessment will be made to assess the effects of the remedial action on the resource and options to mitigate adverse impacts will be determined and evaluated. Appropriate actions will be taken to comply with ARARs that protect cultural and archeological resources.

Remedial action objectives would be achieved by Alternatives 4a and 4b once excavation and disposal at the proposed ICDF or off-Site facility are complete. To satisfy the RAOs during implementation of these alternatives, radiological exposures to INEEL equipment operators must be reduced to below the INEEL limits of 50 mrem/day and 500 mrem/month, and below the DOE limit of 5,000 mrem/year (LMITCO Manual 15A, *INEEL Radiological Control Manual, Radiation Protection*).

The removal of soils from all WAG 5 soil sites of concern could be achieved in less than 9 months. However, the estimated time to prepare environmental assessments, safety analysis, and design phases, as well as performing the removal and verification sampling, is 18 to 24 months.

***12.2.1.3.6 Implementability***—Alternatives 4a and 4b are easily implementable. Proposed excavation equipment is currently available. Characterization, packaging, transportation, and disposal of contaminated soils all use available technologies. The trained personnel and specialized equipment required would be available. Underground pipelines and utilities remaining after the completion of D&D within ARA-II, -II, and –II could increase the time required to implement soil excavations around these areas, but would not be likely to reduce the overall implementability of the alternative.

***12.2.1.3.7 Cost***—The estimated cost for the conventional excavation and disposal alternatives is moderate to high. Cost estimates are based on the use and operation of excavation equipment and disposal. Cost allowances are used to account for shielding requirements, air pollution controls, monitoring equipment and analyses, waste characterization, and packaging. For Alternative 4b, costs for transport to Envirocare are included. The estimated costs for Alternatives 4a and 4b, $11 million and $24 million, respectively, are summarized in Table 11-1 and presented in detail in Appendix K.

***12.2.1.4 Alternatives 5a and 5b: Removal, Ex Situ Sorting, and Disposal.*** Alternatives 5a and 5b differ only in the final disposal location of the contaminated soils. The proposed ICDF is considered in Alternative 5a while a private disposal facility located off the INEEL is addressed in Alternative 5b. The evaluation of the seven CERCLA screening criteria are the same for both alternatives with the exception of the additional transportation costs and potentially larger disposal costs associated with off-Site disposal.

Alternatives 5a and 5b would involve the following:

- Excavating all soils with contaminant concentrations in excess of PRGs
- Processing radiologically contaminated excavated soil through a segmented gate system to separate soils contaminated above PRGs
- Soils less than the PRGs for radioactivity would be returned to the excavation
- Soils contaminated above PRGs at sites with an ecological risk only (ARA-01, and PBF-16) would be excavated and disposed of with the radiologically contaminated soils
- Verification sampling
- Site restoration.

Conventional excavation would be performed as previously described. Soils would first be processed through the sorter to segregate soils contaminated with radionuclides in concentrations above the PRGs. Soils exhibiting concentrations less than PRGs would be returned to the excavation site. Radiologically contaminated waste would be disposed of along with the soils from the sites with an ecological risk. Two assumptions were adopted to facilitate cost estimating for these alternatives: (1) the soil separation technology would result in a 50% reduction in the soil volume requiring disposal, and (2) the disposal facility off the INEEL would be Envirocare in Clive, Utah.

***12.2.1.4.1 Overall Protection of Human Health and the Environment***—Alternatives 5a and 5b provide highly effective, long-term protection of human health and the environment. The removal of all soil with an unacceptable ecological risk and radiologically contaminated soil in concentrations greater than the PRGs followed by disposal in a secure landfill would eliminate potential long-term human health and environmental concerns. These alternatives also are environmentally protective during

implementation because mitigative measures to prevent contaminant migration during excavation activities would be implemented.

***12.2.1.4.2 Compliance with ARARs***—The evaluation of Alternatives 5a and 5b for compliance with ARARs and TBCs is presented in Table 12-5. Available data indicate that no RCRA hazardous waste is present at WAG 5 contaminated soil sites. This conclusion will be verified through analysis and waste designation during excavation. If any soils are determined to be classified as RCRA-regulated waste, the ARARs listed in Table 12-1 for this alternative will apply. These soils will be disposed of at a compliant facility, such as the proposed ICDF or Envirocare. Therefore, the RCRA ARARs will be met. Compliance with the emission control ARARs would be ensured by performing the excavation using air monitoring and dust suppression techniques. All areas affected by WAG 5 remedial activities would be evaluated for archeological resource value before disturbance. Activities in sensitive areas would be modified as required to meet ARARs. The TBC would be met by implementing applicable provisions of the DOE order. These alternatives are, therefore, capable of complying with ARARs and TBCs.

***12.2.1.4.3 Long-Term Effectiveness and Permanence***—Alternatives 5a and 5b have a high potential for achieving long-term effectiveness and permanence because contaminated soils would be completely removed from WAG 5. The long-term risk to human health and the environment would be transferred from the WAG 5 contaminated soil sites to the proposed ICDF or an off-Site facility.

***12.2.1.4.4 Reduction of Toxicity, Mobility, or Volume Through Treatment***— Toxicity and mobility of contaminants would not be reduced. However, soil sorting using a monitor and gate system would reduce the volume of radiologically contaminated soils requiring disposal. Actual reductions are site-specific and could be determined only during testing.

***12.2.1.5 Short-Term Effectiveness***—The exposure risks to workers during excavation and removal of contaminated soil at WAG 5 sites could be significant. However radiation monitoring and dust control measures have been demonstrated to effectively mitigate risks in previous INEEL removal actions. Short-term effectiveness is, therefore, considered moderate. Equipment operator exposures to soils contaminated with radionuclides or toxic metals would be inhibited using standard protective measures. Supplied air and shielding would be used as needed. Excavation equipment modified with positive-pressure ventilation system cabs and HEPA filters for use in radiologically contaminated areas is available at the INEEL. Excavation equipment can be modified to provide additional protection in radioactively contaminated environments. Equipment operator risks will be directly related to the time required to perform the excavation along with distance from the soil and shielding provided by equipment and protective clothing. Inhalation and ingestion risks caused by toxic metals in soil could be minimized by use of appropriate personnel protective equipment, engineering controls, and adherence to health and safety protocols.

In addition to risks caused by exposure to contaminants, risks associated with the physical construction hazards, such as vehicle accidents or personal injury can be minimized by implementation of appropriate health and safety measures for earth-moving construction activities.

The environmental impacts resulting from these alternatives would similar to those for the excavation and disposal Alternatives 4a and 4b. The possible location of archeological resources at the WAG 5 soil sites is recognized, and actions will be taken to comply with ARARs.

**Table 12-5.** Evaluation of compliance with ARARs and TBCs for contaminated soil sites: Alternative 5a: Removal, Ex Situ Treatment, and Disposal on the INEEL; and Alternative 5b: Removal, Ex Situ Treatment, and Disposal off the INEEL.

| ARAR or TBC | Type | Citation | Met Evaluation[a] |
|---|---|---|---|
| Idaho Hazardous Waste Management Act | Action | IDAPA 16.01.05.006, which incorporates RCRA by reference | Yes |
| Resource Conservation and Recovery Act | Action | 40 CFR 262.11, Hazardous Waste Determination | Yes |
| Rules for Control of Air Pollution in Idaho | Action | IDAPA 16.01.01.650-.651, Fugitive Dust | Yes |
| Rules for Control of Air Pollution in Idaho | Action | IDAPA 16.01.01.210, 585, and .586, Toxic Air Pollutants | Yes |
| National Emission Standards for Hazardous Air Pollutants | Action | 40 CFR 61.91 and .92, national emission standards for emissions of radionuclides other than radon from DOE facilities | Yes |
| Native American Graves Protection and Repatriation Act | Location | 25 USC 32 | Yes |
| National Archeological and Historic Preservation Act | Location | 36 CFR 800 | Yes |
| Limit of 100 mrem/year effective dose equivalent to the public from exposures to external and internal radiation sources. | TBC[b] | DOE Order 5400.5, "Radiation Protection of the Public and the Environment" | Yes |
| Limit of 10 mrem/year effective dose equivalent to the public from airborne releases. | TBC | DOE Order 5400.5 | Yes |

a. A yes in the Met Evaluation column indicates that the alternative meets the ARAR or TBC.

Note: The table incorporates the assumption that all environmental siting, construction, and operation ARARs for the proposed ICDF will be identified and addressed in a separate document.

Remedial action objectives would be achieved by these alternatives upon the completion of excavation, separation, and disposal. The estimate time required to remove and sort the contaminated soil is less than 9 months. However, the estimated time to prepare environmental assessments, safety analysis, and design phases, as well as perform the removal and verification sampling, is 18 to 24 months.

***12.2.1.5.1 Implementability***—Implementability is considered moderate for Alternatives 5a and 5b. Segmented gate separation of radionuclide-contaminated soils will be evaluated at the pilot-scale level at WAG 5 in 1999.

***12.2.1.5.2 Cost***—The estimated costs for Alternatives 5a and 5b, $16 million and $23 million, respectively, are summarized in Table 11-1 and presented in detail in Appendix K. Costs are classified as high.

### 12.2.2 ARA-02 Sanitary Waste System

***12.2.2.1 Alternative 1: No Action.*** The no action alternative provides a baseline against which other alternatives can be compared. Under this alternative, existing management practices currently in place at ARA-02 would be continued.

***12.2.2.1.1 Overall Protection of Human Health and the Environment***—Under the no action alternative, human health and environmental risks would not be mitigated. The absence of controls for the ARA-02 seepage pit sludge results in no reduction of long-term risks other than by natural radioactive decay. For purposes of this FS and to meet the intent of the NCP, it is assumed for the evaluation of the no action alternative that the site could become immediately accessible to the general public. Remedial action objectives would not be met for the ARA-02 seepage pit under the no action alternative.

***12.2.2.1.2 Compliance with ARARs and TBCs***—The evaluation of the no action alternative for compliance with the ARARs and TBCs is presented in Table 12-6. None of the RCRA and IDAPA hazardous waste ARARs would be met for the ARA-02 seepage pit because RCRA characteristic and listed waste would remain in place. Chemical-specific ARARs would be met because there would not be air emissions from the waste and impacts on groundwater quality are not likely. Though the BRA did not evaluate past operational releases to the subsurface from ARA-02, the quantities of contaminants remaining in the seepage pit are relatively small. Therefore, groundwater quality ARARs would not be pertinent.

The DOE Order 5400.5 TBC would only be met for the period of institutional control.

***12.2.2.1.3 Long-Term Effectiveness and Permanence***—Alternative 1 does not provide long-term and permanent control of human and environmental exposure to the ARA-02 seepage pit sludge. There are no measures to prevent release of contaminants from the site. Therefore, because potential releases of contaminants are not prevented, the long-term effectiveness and permanence of the no action alternative is considered low.

***12.2.2.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment***— No treatment is associated with Alternative 1. Toxicity, mobility, and volume of seepage sludge would remain unchanged with the exception of natural radioactive decay.

***12.2.2.1.5 Short-Term Effectiveness***—Alternative 1 can be implemented readily without additional risks to the community, workers, or the environment. No specialized equipment, personnel, or services are required to implement the no action alternative.

***12.2.2.1.6 Cost***—Estimated costs for the no action alternative, $9.3 million, are summarized in Table 11-2 and presented in detail in Appendix K. Costs for 100 years of monitoring are included.

***12.2.2.1.7 Implementability***—No implementation concerns are associated with the no action alternative.

***12.2.2.2 Alternative 3: Removal, Ex Situ Thermal Treatment, and Disposal.*** Alternative 3 consists of removing and shipping the ARA-02 seepage pit sludge for thermal treatment outside of WAG 5, disposing of the treatment residuals off-Site, excavating and removing the structural components of the sanitary waste system, decontaminating or encapsulating the debris, and disposing of the debris either at a facility off the INEEL or at a disposal site on the INEEL. The ARA-02 seepage pit sludge would be packaged for shipment and incineration at WERF, and the treatment residuals would be transported for disposal at a permitted off-Site disposal facility such as Envirocare. The most likely disposal location for the seepage pit pumice blocks, septic tanks, and piping would be a permitted off-Site facility such as Envirocare. If the proposed ICDF is constructed and approved to accept RCRA waste, the treated sludge and structural components could possibly be disposed on-Site.

**Table 12-6.** Evaluation of compliance with ARARs and TBCs for ARA-02, Alternative 1: No Action.

| ARAR or TBC | Type | Citation | Met Evaluation[a] |
|---|---|---|---|
| Idaho Hazardous Waste Management Act | Action | IDAPA 16.01.05.006, .008, and .011, which incorporate RCRA by reference | No |
| Resource Conservation and Recovery Act | Action | 40 CFR 262.11, Hazardous Waste Determination<br>40 CFR 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities<br>40 CFR 268, Land Disposal Restrictions | No |
| National Emission Standards for Hazardous Air Pollutants | Action | 40 CFR 61.92 and .93, national emission standards for emissions of radionuclides other than radon from DOE facilities | Yes |
| Idaho Ground Water Quality Rule | Chemical | IDAPA 16.01.11.200, Groundwater Quality Standards | Yes |
| Limit of 100 mrem/year effective dose equivalent to the public from exposures to external and internal radiation sources. | TBC | DOE Order 5400.5, "Radiation Protection of the Public and the Environment" | No |
| Limit of 10 mrem/year effective dose equivalent to the public from airborne releases. | TBC[b] | DOE Order 5400.5 | No |

a. A yes in the Met Evaluation column indicates that the alternative meets the ARAR or TBC.

***12.2.2.2.1 Short-Term Effectiveness***—The exposure risk to workers during excavation, removal, containerization, and transport of the seepage pit sludge and associated debris would be low to moderate because the radiological and chemical contamination levels are low. Short-term effectiveness is, therefore, considered moderate. Equipment operator and worker exposures would be minimized using established procedures.

***12.2.2.2.2 Overall Protection of Human Health and the Environment***—Alternative 3 would provide highly effective, long-term protection of human health and the environment. Removal of all seepage pit sludge would eliminate potential long-term risks from exposure or contaminant migration. Therefore, Alternative 3 meets specified RAOs and provides for overall protection of human health and the environment.

***12.2.2.2.3 Compliance with ARARs and TBCs***—Table 12-7 presents the evaluation of Alternative 3 for compliance with ARARs and TBCs. The RCRA and IDAPA ARARs specific to hazardous waste will be met. Using air monitoring and dust suppression techniques during construction and excavation would ensure compliance with emissions ARARs. Controlling the off-gases generated during the thermal treatment process will be the responsibility of the treatment vendor and is not relevant to actions conducted within WAG 5. The site will be surveyed for cultural and archeological resources and appropriate actions taken to satisfy ARARs protection of sensitive resources. The DOE Order 5400.5 TBC would be met through administrative and engineering controls to limit exposures to allowable levels.

***12.2.2.2.4 Long-Term Effectiveness and Permanence***—Alternative 3 provides for long-term and permanent prevention of exposure to ARA-02 seepage pit sludge at WAG 5. The long-term risks are basically transferred from ARA-02 to the treatment and disposal facilities. The management practices for the facilities would ensure protection of human health and the environment. The long-term effectiveness and permanence of Alternative 3 is considered high.

**Table 12-7.** Evaluation of ARARs and TBCs—for ARA-02 Alternative 3: Removal, Ex Situ Thermal Treatment, and Disposal.

| ARAR or TBC | Type | Citation | Met Evaluation[a] |
|---|---|---|---|
| Idaho Hazardous Waste Management Act | Action | IDAPA 16.01.05.006, .008, and .011 which incorporate RCRA by reference | Yes |
| Resource Conservation and Recovery Act | Action | 40 CFR 262.11—Hazardous Waste Determination<br>40 CFR 264—Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities<br>40 CFR 268—Land Disposal Restrictions | Yes |
| Rules for Control of Air Pollution in Idaho | Action | IDAPA 16.01.01.650–.651—Fugitive Dust | Yes |
| Rules for Control of Air Pollution in Idaho | Action | IDAPA 16.01.01.210—Preconstruction Compliance with Toxic Standards<br><br>IDAPA 16.01.01.585 and .586—Toxic Air Emissions | Yes |
| National Emission Standards for Hazardous Air Pollutants | Action | 40 CFR 61.92 and .93—National Emission Standards for Emissions of Radionuclides other Than Radon from Department of Energy Facilities | Yes |
| Rules for Control of Air Pollution in Idaho | Location | IDAPA 16.01.01.581—Prevention of Significant Deterioration | Yes |
| Native American Graves Protection and Repatriation Act | Location | 25 USC 32 | Yes |
| National Archeological and Historic Preservation Act | Location | 36 CFR 800 | Yes |
| Limit of 100 mrem/year effective dose equivalent to the public from exposures to external and internal radiation sources. | TBC | DOE Order 5400.5 | Yes |
| Limit of 10 mrem/year effective dose equivalent to the public from airborne releases. | TBC | DOE Order 5400.5 | Yes |

a. A yes in the Met Evaluation column indicates that the alternative meets the ARAR or TBC.

***12.2.2.2.5 Reduction of Toxicity, Mobility, or Volume Through Treatment***—Thermal treatment would destroy the organic COCs and significantly reduce the volume of waste. The toxicity of the radionuclides and toxic metals would not be reduced, though contaminant mobility in the WERF treatment residuals would be minimized at the disposal location.

Construction risks to workers also are a consideration during excavation, packaging, storage, and treatment activities. These risks result primarily from physical construction hazards such as vehicle accidents or personnel injuries. However, implementation of appropriate health and safety measures for the excavation and treatment activities can minimize these risks.

Environmental impacts resulting from this alternative may be significant. Sensitive archeological sites may exist at ARA-02. Surveys will be conducted before any disturbance, and actions taken as necessary to comply with ARARs in the event resources are discovered during the surveys.

Remedial action objectives would be achieved by this alternative once treatment was complete.

***12.2.2.2.6 Implementability***—Alternative 3 is completely implementable. Facilities to treat and dispose of the ARA-02 seepage pit sludge and related debris are presently operational and existing information indicates that the sludge and debris would meet the acceptance criteria for these facilities.

***12.2.2.2.7 Cost***—The estimated costs for Alternative 3, $2 million, are summarized in Table 11-2 and presented in detail in Appendix K.

***12.2.2.3 Alternative 4: In Situ Stabilization and Encapsulation.*** Alternative 4 would consist of partially filling the seepage pit with soil and then grouting the seepage pit sludge and pumice blocks in place. In addition, the three empty concrete septic tanks and associated piping would be filled with grout. Jet grouting would be used in the seepage pit to ensure the sludge was adequately mixed with the grout material to stabilize the waste and completely encapsulate the entire seepage pit. After the seepage pit is stabilized and encapsulated, a gravity feed system would be used to fill the remainder of the septic system with grout.

Institutional controls and environmental monitoring would be implemented to restrict access and confirm contamination was not migrating from the site. Institutional controls would include deed restrictions and fencing. The environmental monitoring would include ground water and vadose zone monitoring, radiation surveys, and soil sampling and analysis. Five-year reviews would be conducted to evaluate the effectiveness of the institutional controls and treatment.

***12.2.2.3.1 Overall Protection of Human Health and the Environment***—Combined with institutional controls and monitoring, this alternative would provide long-term protection of human health and the environment. Stabilizing and encapsulating the waste would eliminate ingestion and dermal adsorption pathways. Direct radiation exposure risks would be eliminated because at least 9 ft of soil and grout would cover the sludge, which would effectively shield human and ecological receptors. Therefore, the stabilization and encapsulation alternative meets the RAOs and provides overall protection of human health and the environment.

***12.2.2.3.2 Compliance with ARARs and TBCs***—Table 12-8 presents the evaluation of Alternative 4 for compliance with ARARs and TBCs. Compliance with fugitive dust control ARARs would be ensured by using water sprays as necessary during equipment mobilization and operation. The jet grouting system is equipped with a gas collection and HEPA filtration system, which will ensure that NESHAPs ARARs are met. Before remediation, an analysis will be performed to determine whether controls for TAPs emissions are necessary. If required, an activated carbon filter can be installed on the jet grouting system to capture any toxic emissions that would not be captured on the HEPA filtration unit.

Surveys would be conducted at ARA-02 before any disturbance to determine the presence of any cultural resource. In the event that cultural resources are discovered, activities would be modified to comply with ARARs. The DOE Order 5400.5 TBC would be met through administrative and engineering controls to ensure exposures were within allowable levels.

***12.2.2.3.3 Long-Term Effectiveness and Permanence***—This alternative would achieve long-term effectiveness and permanence by stabilizing and encapsulating the seepage pit sludge and associated septic system in a grout matrix. In the geologic environment, grout is resistant to weathering. Assuming that the local geology does not undergo a major chemical or thermal change, the treated waste

**Table 12-8.** Evaluation of ARARs and TBCs –for ARA-02 Alternative 4: In Situ Stabilization and Encapsulation.

| ARAR or TBC | Type | Citation | Met Evaluation[a] |
|---|---|---|---|
| Idaho Hazardous Waste Management Act | Action | IDAPA 16.01.05.006, .008, and .011, which incorporate RCRA by reference | Yes |
| Resource Conservation and Recovery Act | Action | 40 CFR 262.11—Hazardous Waste Determination | Yes |
| Rules for Control of Air Pollution in Idaho | Action | IDAPA 16.01.01.650–.651—Fugitive Dust | Yes |
| Rules for Control of Air Pollution in Idaho | Action | IDAPA 16.01.01.210—Preconstruction Compliance with Toxic Standards<br><br>IDAPA 16.01.01.585–.586—Toxic Air Emissions | Yes |
| National Emission Standards for Hazardous Air Pollutants | Action | 40 CFR 61.92 and .93—National Emission Standards for Emissions of Radionuclides other Than Radon from Department of Energy Facilities | Yes |
| Rules for Control of Air Pollution in Idaho | Location | IDAPA 16.01.01.581—Prevention of Significant Deterioration | Yes |
| Native American Graves Protection and Repatriation Act | Location | 25 USC 32 | Yes |
| National Archeological and Historic Preservation Act | Location | 36 CFR 800 | Yes |
| Limit of 100 mrem/year effective dose equivalent to the public from exposures to external and internal radiation sources. | TBC | DOE Order 5400.5, "Radiation Protection of the Public and the Environment" | Yes |
| Limit of 10 mrem/year effective dose equivalent to the public from airborne releases. | TBC | DOE Order 5400.5 | Yes |

a. A yes in the Met Evaluation column indicates that the alternative meets the ARAR or TBC.

would remain stable for more than 1,000 years.[a] The long-term human health risks would be eliminated through treatment, except for direct radiation exposure, which would be reduced by at least 9 ft of grout and soil overburden.

***12.2.2.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment***—Mobility of the COCs would be nearly eliminated through treatment. Neither plant roots nor burrowing animals would penetrate the grouted waste, eliminating these potential human and ecological exposure pathways. Volume of contaminated media would be increased by 20 to 50%. Toxicity would not be reduced.

a. Loomis, G. G., developer of the jet grouting technique at the Idaho National Engineering and Environmental Laboratory, January 1999, Interdepartmental personal communication with B. J. Broomfield, Lockheed Martin Idaho Technologies Company.

The treatment process is considered irreversible because the COCs would be immobilized for at least 1,000 years. Residuals remaining after treatment would include personal protective equipment and the air pollution control systems (e.g., HEPA filters and carbon adsorption media). All residual waste would be characterized and managed according to ARARs.

***12.2.2.3.5 Short-Term Effectiveness***—Hazards to workers during implementation include ejection of grout and construction hazards. However, risks to workers during in situ stabilization and encapsulation could be mitigated using standard administrative and engineering controls. Short-term effectiveness is, therefore, assessed as moderate.

Environmental impacts for this alternative are minimal because all activities would occur in previously disturbed areas. Surveys would be performed around ARA-02 before any disturbances, and activities modified to comply with ARARs if any archeological resources are discovered. The RAOs would be achieved once treatment was completed.

***12.2.2.3.6 Implementability***—Alternative 4 is completely implementable. This technology been tested and demonstrated at the INEEL for remediating a waste site. No technical restraints have been imposed for use of the alternative, and all equipment and trained, experienced personnel are available to perform the work. No soils or seepage pit sludge would be removed from the site; hence, administrative implementability is high.

***12.2.2.3.7 Cost***— The estimated costs for Alternative 4, $7.5 million, are summarized in Table 11-2 and presented in detail in Appendix K. Costs for 100 years of monitoring are included.

### 12.2.3 ARA-16 Radionuclide Tank

***12.2.3.1 Alternative 1: No Action.*** The no action alternative provides a baseline against which other alternatives can be compared. Under this alternative, existing management practices currently in place at ARA-16 would be continued with the addition of expanded monitoring.

***12.2.3.1.1 Overall Protection of Human Health and the Environment***—Under the no action alternative for the ARA-16 radionuclide tank, human health and environmental risks would not be mitigated. The additional monitoring of the ARA-16 waste tank during the period of institutional control would allow detection of a release, which could then be mitigated. However, after the period of institutional control, tank monitoring would be discontinued and risks to the human health and the environment could increase. For the purposes of this FS and to meet the intent of the NCP, it is assumed for the evaluation of the no action alternative that the site could become immediately accessible to the general public. Remedial action objectives would not be met for ARA-16 under the no action alternative.

***12.2.3.1.2 Compliance with ARARs and TBCs***—The evaluation of the no action alternative for compliance with the ARARs and TBCs is presented in Table 12-9. None of the RCRA and IDAPA hazardous waste ARARs would be met because RCRA characteristic and listed waste would remain in place. The TSCA ARAR would not be met because regulated concentrations of PCBs would remain in the tank. All other chemical-specific ARARs would be met because there would not be air emissions from the waste and impacts on groundwater quality are not likely. Though the BRA did not evaluate the release of the ARA-16 tank contents, groundwater quality ARARs would still be pertinent but would only be met during the period of institutional control through monitoring.

The DOE Order 5400.5 TBC would be met only for the period of institutional control.